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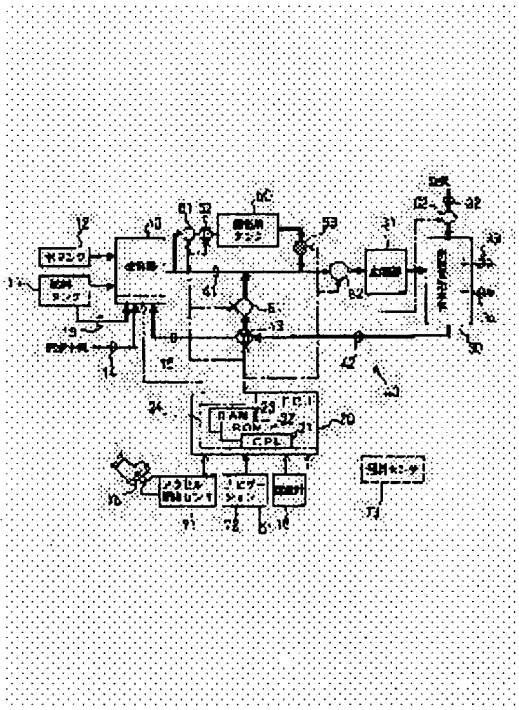
(54) FUEL CELL SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a fuel cell system, which can deal with the sudden increase of a load, small, and easy in constitution.

SOLUTION: An ECU 20, in accordance with the shortage situation of hydrogen needed on the side of a fuel cell main body 30, opens an open/close valve 53 to use hydrogen in a buffering tank 50, or switches a three-way valve 43 to actruate a booster 61 to make the reflux of unconverted hydrogen, or to actuate boosters 62 and 63 to increase introducing pressure. When the temporary increase of necessary hydrogen quantity is needed, practical power generation quantity can be obtained to the temprorary sudden increase of a load, regardless of a small buffer tank 50, by utilizing hydrogen in the tank 50 and the in a pipe.



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CLAIMS

[Claim(s)]
[Claim 1] A fuel gas manufacture means to be the fuel cell system which is equipped with a fuel cell and supplies power outside using this fuel cell, and to generate the fuel gas for fuel cells, A piping way including the path for gas supply from this fuel gas manufacture means to said fuel cell, and the flueway from this fuel cell, It is placed between this path for supply of this piping way. The tank for a buffer which can store said fuel gas, When a temporary increment in a power demand is detected by an amount-required detection means to detect a temporary increment in the power demand from the outside to said fuel cell, and this amount-required detection means, The fuel cell system equipped with the increment means in the amount of reactant gas to which the capacity supplied to said fuel cell is made to increase temporarily using the fuel gas of the inside of said piping way, and said tank for a buffer.
[Claim 2] It is the fuel cell system which is a means to input the information on geographical feature that are a fuel cell system according to claim 1, this fuel cell system is a system which supplies the drive energy of a vehicle, and a vehicle runs in said amount-required detection means, and to detect a temporary increment in a power demand.
[Claim 3] It is a fuel cell system according to claim 1. This fuel cell system It is the system which supplies the drive energy of a vehicle. Said amount-required detection means A geographical feature information storage means by which the terrain intelligence of the transit range of a vehicle was memorized beforehand, and a transit information detection means to detect the transit information which includes the transit location and the transit direction of a vehicle at least, The fuel cell system equipped with a presumed means for said geographical feature information storage means to memorize, and to presume temporary fluctuation of a power demand of the future with reference to a terrain intelligence based on the detected this transit location and the transit direction.
[Claim 4] It is the fuel cell system equipped with a reflux means to make the fuel cell concerned supply again the unreacted fuel gas with which it is a fuel cell system given in any [claim 1 thru/or] of 3 they are, and said increment means in the amount of reactant gas exists in a flueway from said fuel cell.
[Claim 5] It is the fuel cell system equipped with the increment means in the introducing pressure force to which the pressure of the fuel gas which supplies said increment means in the amount of reactant gas to said fuel cell in a fuel cell system given in any [claim 1 thru/or] of 4 they are is made to increase.
[Claim 6] It is the fuel cell system which is the tank which stores 1/2 or less [of the amount of fuel gas which said fuel cell needs corresponding to an increment with the demand power are a fuel cell system according to claim 1, and temporary with which said tank for a buffer was detected by said amount-required detection means].
[Claim 7] The fuel cell system equipped with a supplement means to be a fuel cell system according to claim 1, and to replace with the predetermined timing after a temporary increment in said power demand is completed the fuel gas in said tank for a buffer lost when said increment means in the amount of reactant gas used with the fuel gas manufactured by said fuel gas manufacture means.
[Claim 8] The fuel cell system which it had in the increment means in the amount of manufactures to which the amount of manufactures of the fuel gas by said fuel-gas manufacture means makes increase

when the increment which exceeds the predetermined period of a power demand with an increment detection means in amount-required continuation are a fuel cell system according to claim 2 or 3, and detect the increment exceeding the predetermined period of the power demand from the outside to said fuel cell, and this increment detection means in amount-required continuation is detected.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About a fuel cell system, since it corresponds to a rapid load effect especially, this invention relates to the fuel cell system equipped with the tank for a buffer.
[0002]
[Description of the Prior Art] Conventionally, using fuel gas manufacture means, such as a reforming machine, the hydrogen as fuel gas is generated with a reforming vessel, and the fuel cell system which generates electricity with a fuel cell using this hydrogen is known. In such a fuel cell system, there is time lag in the generating capacity of hydrogen with a reforming machine, and it cannot fully respond to rapid increase of the electric energy which the load of a fuel cell requires. For example, if in a case automatic [using this fuel cell system / electric] a vehicle puts in a steep uphill or it gets into an accelerator suddenly, the power which the motor which is a load needs, i.e., the demand power to a fuel cell, will increase rapidly, and the consumption of the hydrogen which is fuel gas in a fuel cell will also increase rapidly. On the other hand, since the time amount for dozens of seconds is needed at least in order to raise the reforming reaction of the hydrogen in a reforming machine, the condition of saying that the supply does not fulfill demand to consumption of the hydrogen in a fuel cell appears.
[0003] In order to solve this problem, what formed the tank for a buffer in the piping way of hydrogen (for example, JP,58-166674,A), and the thing (for example, JP,6-82756,U) which formed the tank for a buffer which carried out hydrogen storing metal alloy restoration in the piping way of hydrogen are known. These fill up the tank for a buffer with hydrogen beforehand, and when a load is increased rapidly and the consumption of the hydrogen in a fuel cell increases rapidly, they tend to correspond to fluctuation of a load by making the hydrogen accumulated in the tank output.
[0004]
[Problem(s) to be Solved by the Invention] However, in such a conventional fuel cell system, there was a problem that the magnitude of the tank for a buffer will become very large. This point is explained taking the case of an electric vehicle. Since the time lag for dozens of seconds will exist by the time it can generate the hydrogen of the amount demanded even if it is going to control a reforming machine and is going to increase the generating capacity of hydrogen when an electric vehicle puts in an uphill and a load increases, the reservoir capacity needed for the tank for a buffer will be called the storage of extent which can cancel this time lag. The experiment shows that the time lag in the reforming machine of the usual capacity in the present condition is about 30 seconds. On the other hand, when you are going to make it generate maximum capacity with the fuel cell of 30kW class, 400l. the hydrogen for /is needed. Therefore, in the case of the fuel cell system which combined this reforming machine and fuel cell, the hydrogen tank which has 200l. reservoir capacity although the time lag for 30 seconds is canceled must be mounted. Even if it used the tank using the high hydrogen storing metal alloy of a metaphor and reservoir capacity, it was very difficult to carry the tank for a buffer which has the reservoir capacity of only this.
[0005] Moreover, since a heat dissipation or endoergic reaction is followed on the occlusion of

hydrogen, and emission in the case of a hydrogen storing metal alloy, it is necessary to apply a lot of heating values to answering rapid increase of a load and making hydrogen emit. Therefore, when the tank for a buffer using a hydrogen storing metal alloy was used, the problem that a means to control the device for supplying this heating value and supply of a heating value had to be established was also pointed out.

[0006] This invention solves the problem of the fuel cell system mentioned above, and it was small and it was made for the purpose of the thing which can respond to rapid increase of a load and for which a fuel cell system with an easy configuration is offered.

[0007]

[The means for solving a technical problem, and its operation and effectiveness] The 1st fuel cell system of this invention which attains this purpose A fuel gas manufacture means to be the fuel cell system which is equipped with a fuel cell and supplies power outside using this fuel cell, and to generate the fuel gas for said fuel cells, A piping way including the path for gas supply from this fuel gas manufacture means to said fuel cell, and the flueway from this fuel cell, It is placed between this path for supply of this piping way. The tank for a buffer which can store said fuel gas, When a temporary increment in a power demand is detected by an amount-required detection means to detect a temporary increment in the power demand from the outside to said fuel cell, and this amount-required detection means, Let it be a summary to have had the increment means in the amount of reactant gas to which the capacity supplied to said fuel cell is made to increase temporarily using the fuel gas of the inside of said piping way, and said tank for a buffer.

[0008] When a temporary increment in the power demand from the outside to a fuel cell is detected by the amount-required detection means, the capacity which the increment means in the amount of reactant gas supplies to a fuel cell using the fuel gas of the inside of a piping way and the tank for a buffer is made to increase temporarily in this fuel cell system. Use of it not only supplying the fuel gas of the tank for a buffer, but heightening the pressure of fuel gas and raising the generating efficiency in a fuel cell temporarily as a gestalt of use of the fuel gas of the inside of a piping way and the tank for a buffer is also possible. Moreover, as use of the fuel gas in a piping way, not only the use by the rise of such a pressure but correspondence of flowing back and using the unreacted fuel gas which exists in a flueway is possible. Consequently, even when manufacture of the fuel gas by the fuel gas manufacture means does not follow to a temporary increment in demand electric energy, corresponding to the increment in demand electric energy, the amount of fuel gas supplied to a fuel cell can be increased.

[0009] When such a fuel cell system is used as a system which supplies the drive energy of a vehicle, it can consider as a means to input the information on geographical feature that a vehicle runs an amount-required detection means, and to detect a temporary increment in a power demand. As a configuration which inputs the information on the geographical feature a vehicle runs, what inputs the information on an uphill etc., the configuration with which an operator pushes carbon buttons, such as a "climb", are employable from the inclination sensor formed in the vehicle.

[0010] Moreover, it sets to the fuel cell system which supplies the drive energy of such a vehicle. A geographical feature information storage means by which the terrain intelligence of the transit range of a vehicle was beforehand memorized for the amount-required detection means, A transit information detection means to detect the transit information which includes the transit location and the transit direction of a vehicle at least, It is also possible to have a presumed means for said geographical feature information storage means to memorize, and to presume temporary fluctuation of a power demand of the future with reference to a terrain intelligence, based on the detected this transit location and the transit direction.

[0011] The geographical feature which a vehicle will be putting with this fuel cell system in the near future can be presumed, and temporary fluctuation of a power demand can be presumed. It is also possible to carry the navigation system using GPS etc. by the latest vehicle, to presume temporary fluctuation of a power demand from a future transit location using such a navigation system, and to prepare for fluctuation of the consumption of fuel gas. In addition, not only inclination but the information on a highway etc. can be included in a terrain intelligence. It predicts advancing into the

future highway where a vehicle is near in such a case, and it is also possible to presume a temporary increment in the demand power at the time of advancing into a highway from a lamp and accelerating.
[0012] In the fuel cell system of this invention, it can consider as the tank which stores 1/2 or less [of the amount of fuel gas for which a fuel cell needs the tank for a buffer corresponding to a temporary increment in the demand power detected by the amount-required detection means]. If the increment means in the amount of reactant gas uses by the various technique of having mentioned above the fuel gas of the inside of a piping way, and the tank for a buffer, the storage of the tank for a buffer can be reduced to 1/2 of the amount of fuel gas which a fuel cell needs corresponding to a temporary increment in demand power thru/or about 1/7.
[0013] Furthermore, since the fuel gas in the tank for a buffer may be used by the increment means in reactant gas in the fuel cell system of this invention, it is the predetermined timing after a temporary increment in a power demand is completed, and it is also suitable to have a supplement means to fill up the fuel gas in the tank for a buffer lost when the increment means in the amount of reactant gas used with the fuel gas manufactured by the fuel gas manufacture means. The supplement of this fuel gas may be performed by increasing the amount of manufactures of the fuel gas by the fuel gas manufacture means, may detect that the amount of fuel gas which a fuel cell needs decreases, and may perform it using the timing which the amount of the fuel gas which a fuel cell needs is reducing.
[0014] Moreover, when the increment which exceeds the predetermined period of a power demand with an increment detection means in amount-required continuation detect the increment exceeding the predetermined period of the power demand from the outside to a fuel cell, and this increment detection means in amount-required continuation is detected, it is possible in the fuel cell system which supplies the drive energy of a vehicle also in having the increment means in the amount of manufactures to which the amount of the fuel gas by the fuel-gas manufacture means of manufactures makes increase. In this case, to a temporary increment, correspondence by the increment means in the amount of reactant gas will be made, and correspondence by the increment means in the amount of manufactures will be made to a continuous increment.
[0015]
[Embodiment of the Invention] In order to clarify further a configuration and an operation of this invention explained above, the suitable example of this invention is explained below. the block diagram in which drawing 1 shows the outline configuration of the fuel cell system as one example of this invention, the block diagram showing the outline configuration of the navigation system to which drawing 2 outputs the terrain intelligence as a control input, and the flow chart which shows the contents [in / in drawing 3 / the 1st example] of control -- it comes out.
[0016] The fuel cell system of this example consists of electronic controls (henceforth an ECU) 20 which control the bulb, booster, and reforming machine 10 grade prepared in the tank 50 for a buffer infixed in the piping way 40 which connects the reforming machine 10 which manufactures the hydrogen which is fuel gas of a fuel cell, the body 30 of a fuel cell which performs a generation of electrical energy from hydrogen and oxygen, and the reforming machine 10 and the body 30 of a fuel cell, and the piping way 40, and the piping way 40.
[0017] The reforming machine 10 makes hydrocarbon compounds, such as a methanol supplied from a fuel tank 11, and the water supplied from a water tank 12 react, and generates hydrogen. The burner for obtaining heat energy required for a reforming reaction was built in this reforming machine 10, and it is equipped with combustion fuel Rhine 13 which supplies a methanol from a fuel tank 11 as that fuel, and combustion-air Rhine 14 which incorporates the air for combustion from atmospheric air. The amount of supply of such methanols and air has become controllable, and based on the control signal inputted from ECU20 mentioned later, the reforming machine 10 can change terms and conditions, such as temperature of a reforming reaction, and can fluctuate the yield of hydrogen.
[0018] This reforming machine 10 corresponds to a fuel gas manufacture means. Although what generates hydrogen from a methanol as a fuel gas manufacture means in this example is explained as an example, about the raw material and product, well-known various configurations are [that what is necessary is just what generates the fuel gas which the body 30 of a fuel cell mentioned later needs]

employable. Moreover, although temperature of the part where a fuel is burned with the built-in burner and the reforming reaction of the reforming machine 10 is performed is made into predetermined temperature in this example, it can change suitably also about the heating approach and the reaction approach. In addition, in supplying a fuel to a burner in this example, it also has unreacted hydrogen-burning Rhine 15 which supplies the unreacted hydrogen discharged from the body 30 of a fuel cell, and it is also possible to supply this unreacted hydrogen to a burner and to present combustion, if it will be in the condition of the body 30 of a fuel cell of being operated regularly. Use of unreacted hydrogen is explained in full detail later.

[0019] The body 30 of a fuel cell is the well-known fuel cell which used the solid-state polyelectrolyte film, is connect with the reforming machine 10 through the piping way 40, and generates electricity under a predetermined temperature environment using the mixed gas of the reformed gas and the steam containing the hydrogen humidified with the humidifier 31 which intervened all over this piping way 40, and the oxygen in the air supply from air Rhine 32. The reaction for a generation of electrical energy uses the well-known thing, and supplies power outside from the electrodes 33 and 34 of a pair. Since a generation of electrical energy with the body 30 of a fuel cell is restricted by the amount of the fuel gas supplied fundamentally, it can control the amount of the fuel gas to supply suitably, and can control generation-of-electrical-energy capacity. Moreover, as mentioned above, the body 30 of a fuel cell has discharged the unreacted hydrogen which remained in the reaction process, and supplies it to unreacted hydrogen-burning Rhine 15 in the reforming machine 10 using a part of piping way 40. In addition, the generation-of-electrical-energy capacity of the body 30 of a fuel cell of this example is 30kW class.

[0020] Although there is much what generally makes hydrogen fuel gas as a fuel cell, about the raw material and especially a reaction, it is not limited just possible [a generation of electrical energy] using the fuel gas supplied from the reforming machine 10 etc. Although the solid-state polyelectrolyte film was used, fuel cells of various formats, such as an others and alkalinity electrolyte mold fuel cell, an acid electrolyte mold fuel cell, a fused salt (for example, melting carbonate) electrolyte mold fuel cell, a solid oxide fuel cell, and a phosphoric acid fuel cell, can be used.

[0021] The piping way 40 which connects the reforming machine 10 and the body 30 of a fuel cell is equipped with the outward trip section 41 which supplies hydrogen to said humidifier 31 from the reforming machine 10 at least, and the return trip section 42 which returns unreacted hydrogen to the reforming machine 10 side from the body 30 of a fuel cell. These outward trip sections 41 and return trip sections 42 are connected through the Mikata bulb 43 which switches closing motion and is controlled by ECU20. This Mikata bulb 43 has usually closed between the outward trip section 41 and the return trip sections 42, and the unconverted gas is made to be returned to unreacted hydrogen-burning Rhine 15 from the return trip section 42.

[0022] The tank 50 for a buffer is connected to juxtaposition at the outward trip section 41 in this piping way 40. The tank 50 for a buffer has the volume which can store about 30l. hydrogen, the booster 51 and the closing motion bulb 52 which consist of a compressor are connected to an inspired air flow path, and the closing motion bulb 53 is connected to the exhaust side. This tank 50 for a buffer is temporarily accumulated, when the amount of surplus is in the amount of hydrogen emitted from said reforming machine 10 rather than the amount of hydrogen which should be supplied to said body 30 of a fuel cell, and those feeding and discarding are controlled by the control signal outputted to a booster 51, the closing motion bulb 52, and the closing motion bulb 53 from ECU20.

[0023] Although the tank 50 for a buffer used by this example is the usual tank which can store hydrogen, a temporary reservoir of hydrogen is not enabled and the configuration is not asked. For example, it is filled up with the hydrogen storing metal alloy in the tank, and a temperature gradient is given and it may be made to perform adsorption of hydrogen, and emission. Even when which configuration is adopted, when the load of the body 30 of a fuel cell becomes large, the thing [large capacity like it can fully provide required fuel gas] does not assume the tank 50 for a buffer said to this example. By the body 30 of a fuel cell of this example which supplies power to the motor for a drive of an electric vehicle, the case where the demand power increases rapidly can be considered in connection with treading in of an accelerator etc. In order for improvement in the capacity of the reforming machine

10 to catch up to rapid increase of such demand power, about 30 seconds is required of this example. Although the capacity which stores about 200l. hydrogen is needed in order to cancel the time lag for these 30 seconds, in the case of the tank 50 for a buffer adopted by this example, it has capacity of about 30l. Even when a hydrogen storing metal alloy is used, the thing of the capacity which is extent which can carry out occlusion of the equivalent hydrogen is used. About the reason for which the tank 50 for a buffer of 1/several capacity is sufficient from the amount of hydrogen originally needed, it mentions later with control by ECU20.

[0024] Although having closed between the outward trip section 41 and the return trip sections 42 at the time usually already explained the Mikata bulb 43 of the piping way 40 mentioned above, while opening between this outward trip section 41 and the return trip sections 42 based on the control signal from ECU20, between the return trip section 42 and unreacted hydrogen-burning Rhine 15 can be closed. If the booster 61 by which it is placed between serials is driven based on the control signal from ECU20 between this outward trip section 41 and the return trip section 42 at this time, the unreacted hydrogen which is exhausted from the body 30 of a fuel cell, and is passed all over the piping way 40 can be made to flow back in the outward trip section 41. The amount of hydrogen supplied to the body 30 of a fuel cell can be increased temporarily, and the amount of generations of electrical energy can be made to increase by reflux of unreacted hydrogen.

[0025] That is, in this example, the configuration of this piping way 40, the Mikata bulb 43, a booster 61, and ECU20 that controls these constitute a reflux means. Although the reflux path is set up in this way in this example, if the configuration in which the unreacted hydrogen exhausted from the body 30 of a fuel cell is again supplied to the body 30 of a fuel cell is taken, a type, arrangement, etc. of a bulb can be changed suitably. Moreover, it cannot be overemphasized that what is necessary is just to be able to realize reflux of unreacted hydrogen substantially also with the example of control in ECU20 mentioned later.

[0026] On the other hand, it is placed also between air Rhine 32 into which the air which contained oxygen in the body 30 of a fuel cell is sent by the booster 63 while a booster 62 is infixed before a humidifier 31 at the outward trip section 41 of the piping way 40. As for these boosters 62 and 63, the actuation is controlled based on the control signal from ECU20. A drive of these boosters 62 and 63 raises the pressure of hydrogen and the pressure of air which are supplied to the body 30 of a fuel cell. If this introducing pressure force increases, the utilization factor of the oxygen contained in the hydrogen within the body 30 of a fuel cell and air will increase, and the power to generate will also increase.

[0027] Therefore, in this example, these boosters 62 and 63 and ECUs20 constitute the increment means in the introducing pressure force. The various approaches except using the boosters 62 and 63 which become making the introducing pressure force increase from such a compressor etc. are applicable. For example, while arranging a cylinder-piston type pump in the outward trip section 41 of the piping way 40, it connects with an accelerator wire, a piston is pushed in, and it is made possible. If it does in this way, when an accelerator is broken in, the pressure in the piping way 40 will increase, and the same effectiveness will be acquired.

[0028] ECU20 which performs various control mentioned above is equipped with CPU21 of the central processing unit which performs various data processing, ROM22 of the read-only memory which memorizes a program, various data, etc., RAM23 that memorizes temporarily the data used by data processing, I/O24 which performs an exchange of a signal with an external instrument, and is performing the program corresponding to the flow chart shown in drawing 3 R> 3. ECU20 concerned constitutes the amount control means of fuel gas from this semantics.

[0029] On the other hand, the flowmeter 16 for feeding back the amount of hydrogen which it was built in the navigation system 72 and the reforming machine 10 for outputting the accelerator opening sensor 71 and terrain intelligence as a data input means, and was generated is connected to this ECU20.

[0030] The accelerator opening sensor 71 is a position sensor which is connected with an accelerator pedal 75 and detects the amount of treading in of this pedal, and outputs the signal corresponding to the amount of treading in of an accelerator pedal 75 to ECU20. The amount of treading in of an accelerator pedal supports the demand power to the body 30 of a fuel cell in general, and can also presume the load

of the body 30 of a fuel cell only from this amount of treading in.
[0031] In this example, it also has the navigation system 72 for inputting a terrain intelligence further. This navigation system 72 being equipped with the GPS unit, the self-contained navigation unit, the map, and the map matching unit, and searching for positional information by the GPS unit and the self-contained navigation unit, as shown in drawing 2 , it refers to the map data of the map beforehand memorized in the map matching unit, and asks for an exact location. And he is trying to ask for the inclination of the road it is going to run from said place Fig. data the road under transit, and after this.
[0032] In this example, although the inclination information on a road has been acquired by the navigation system 72 as a terrain intelligence, what is necessary is just geographical feature data which affect a load. Therefore, even if it is the premise information which requires a big load like the inlet port of a highway, it can process as geographical feature data similarly. When it thinks as an inclination, you may make it the inclination sensor 73 of a gravity equation detect on the other hand.
[0033] A flowmeter 16 can measure the flow rate of the hydrogen supplied with the reforming vessel 10, and the flowmeter for the gases of the common knowledge which has a movable vane can be used for it. In addition, a flowmeter 16 can also use a pressure gage, if the amount of the hydrogen which does not necessarily need to measure the flow rate of hydrogen directly and is generated can be judged.
[0034] Next, actuation of the fuel cell system of this example is explained, referring to the control program of ECU20. ECU20 will perform fuel cell control processing shown in drawing 3 , if a fuel cell system will be in a busy condition. Starting of this processing inputs basic data at step S110 first. Basic data is the amount of treading in of the accelerator pedal measured by the accelerator opening sensor 71, and the amount of inclinations as a terrain intelligence inputted from a navigation system 72.
[0035] An input of basic data computes the amount of fuel gas (hydrogen) required of step S120. In the case of this example, the initial complements of prospective hydrogen not only including the amount of treading in of an accelerator pedal but the information on the geographical feature are computed. For example, it is calculable with what a big load continues when the inclination shows the uphill, and also in the same amount of treading in of an accelerator pedal, when the inclination shows the downward slope, it can calculate with that to which a load does not become so large, either. From the amount of generations of electrical energy needed, the amount of hydrogen may be calculated correctly, and the required amount of hydrogen may be classified roughly three steps to four steps, and may be calculated, for example.
[0036] Thus, if the initial complement of hydrogen is calculated, according to the initial complement, the amount of the hydrogen used in the current body 30 of a fuel cell and the amount of the hydrogen generated with the reforming vessel 10 will be measured, and the following control will be performed according to a part for an insufficiency or a surplus. In addition, as directions of the yield of the hydrogen to the reforming machine 10, the flow rate of the steam supplied to coincidence is directed, directing the flow rate of the methanol of a raw material etc. Moreover, in parallel to this, the heating value in the reforming machine 10 required for the reforming reaction which makes these a raw material is calculated, the required amount of heating is calculated, and the fuel quantity (a methanol or the amount of unreacted hydrogen) supplied from combustion fuel Rhine 13 and unreacted hydrogen-burning Rhine 15 is directed. The amount of generations of electrical energy in the body 30 of a fuel cell increases according to the amount of the hydrogen fundamentally supplied from the reforming machine 10 etc.
[0037] After calculating the required amount of hydrogen (step S120), it judges whether step S130 is enough as the amount of hydrogen which is carrying out current generating. to the amount of hydrogen which needs the amount of hydrogen generated with the reforming vessel 10, come out enough and be -- without performing the special directions which increase ** and the amount of hydrogen, directions are issued so that the required amount of hydrogen may be continued and it may be made to generate to the reforming machine 10 at step S140. This ends the control based on the basic data inputted at step S110.
[0038] On the other hand, when it is judged at step S140 that the amounts of hydrogen run short, reflux of unreacted hydrogen is first directed at step S150. That is, while outputting a control signal to the Mikata bulb 43 and intercepting connection with the return trip section 42 and unreacted hydrogen-

burning Rhine 15 in the piping way 40, a booster 61 is operated so that this return trip section 42 may be connected to the outward trip section 41 and unreacted hydrogen may be supplied to the body 30 of a fuel cell through the outward trip section 41. If it is in the situation for which judges whether it is that reflux of unreacted hydrogen is sufficient for an insufficiency, and continuing step S160 is sufficient, directions of capacity will be given to the reforming machine 10 in order to generate the hydrogen which is extent which can compensate this insufficiency with step S140, and a fuel control manipulation routine will once be ended.

[0039] Only by reflux of unreacted hydrogen, in being insufficient, it gives the directions which open the tank for a buffer that the hydrogen accumulated in the tank 50 for a buffer should be emitted (step S170). That is, a control signal is outputted so that a valve may be opened to the closing motion bulb 53. Thereby, hydrogen begins to be emitted from the tank 50 for a buffer. Then, it judges whether only the hydrogen in the tank 50 for a buffer is sufficient for an insufficiency. And if it seems that it is sufficient, directions of capacity will be given to the reforming machine 10 so that the hydrogen which is extent which can compensate the insufficiency of hydrogen with step S140 may be generated.

[0040] As mentioned above, the capacity of the tank 50 for a buffer is about 30l. It will get into an accelerator pedal 75 and it will be necessary to operate the body 30 of a fuel cell by the maximum capacity in the situation that generating of the maximum torque was required of the motor of an electric vehicle. In this case, although 400l. the hydrogen for /will be used by the body 30 of a fuel cell, in order to raise the hydrogen production capacity of the reforming machine 10 to this level, this example takes the time amount for about 30 seconds. Consequently, about 200l. hydrogen is needed. Therefore, in reflux of the unreacted hydrogen mentioned above, or emission of the hydrogen in the tank 50 for a buffer, the situation that the hydrogen for performing a required generation of electrical energy runs short arises.

[0041] In such a case, ECU20 drives a booster 62 and a booster 63, and raises the introducing pressure force of the hydrogen to the body 30 of a fuel cell, and atmospheric air (step S190). moreover -- the reforming machine 10 -- receiving -- a hydrogen yield -- the increase of the specified quantity, and ** -- it directs like (step S200). In addition, about the booster 61, pressure-up operation is started at the time of step S150 which made unreacted hydrogen flow back.

[0042] Then, ECU20 returns to step S200, and repeats and directs the increment in a hydrogen yield until it carries out the monitor of the hydrogen yield in the reforming machine 10 based on the input data from a flow meter 16 (step S210), it confirms whether the capacity went up until the amount of hydrogen which the reforming machine 10 generates turns into an initial complement (step S220), and capacity reaches an initial complement. When it goes up until the yield of hydrogen with the reforming machine 10 turns into an initial complement, it directs not to raise capacity more than it to the reforming machine 10, and reforming capacity is maintained (step S230). Moreover, after the amount of hydrogen generated from the reforming machine 10 reaches an initial complement, the pressure up by boosters 62 and 63 is stopped (step S240).

[0043] As explained above, even if the demand of a generation of electrical energy goes up transitionally, by this example, the practical amount of generations of electrical energy can be obtained only by carrying the small tank 50 for a buffer according to the insufficient situation of hydrogen by using the hydrogen in the tank 50 for a buffer, flowing back unreacted hydrogen, or going up the introducing pressure force suitably. Consequently, the configuration of a fuel cell system can be made small and the advantage said that mount becomes easy is acquired.

[0044] Next, the 2nd example of this invention is explained. The fuel cell system of the 2nd example has the same hardware configuration as the 1st example, and only control by ECU20 differs. That is, the fuel cell system of the 2nd example performs the fuel control manipulation routine shown in drawing 4 R> 4. If this manipulation routine is started, ECU20 will perform processing which first reads basic data required for the prediction operation of the amounts of generations of electrical energy, such as a terrain intelligence from the accelerator opening and the navigation system 72 from the accelerator opening sensor 71, (step S300). Next, based on these data, processing which calculates the forecast of the amount of generations of electrical energy which the body 30 of a fuel cell should generate is performed (step

S310).
[0045] When [which judges whether the amount of hydrogen needed increases (step S320), and the required amount of hydrogen increases from such a calculated forecast beyond a predetermined period] it judges, it directs to raise the capacity to the reforming machine 10 (step S330). On the other hand, when it is judged that the increment in the amount of need hydrogen is temporary, it does not direct [as opposed to / especially / the reforming machine 10], but reflux of the unreacted hydrogen by the change of the Mikata bulb 43 or actuation of a booster 61, valve opening of the closing motion bulb 53, the rise of the generating efficiency by use of the hydrogen in the tank 50 for the buffer by actuation of boosters 62 and 63 and the rise of fuel pressure, etc. are performed (step S340). In addition, also when it is judged that the increment in the amount of need hydrogen continues at a predetermined period, processing of reflux of these unreacted hydrogen etc. is performed.
[0046] Although processing when it is judged that there is an increment in the needed amount of hydrogen is as above, after performing the case where it is judged that there is no increment, and the above-mentioned processing, it judges whether there is any reduction of the needed amount of hydrogen (step S360). When the amount of need hydrogen is judged to decrease for a predetermined period, it directs to reduce the capacity to the reforming machine 10 (step S370), and restoration processing of the hydrogen to the tank 50 for a buffer is performed after that (step S380). Restoration processing of hydrogen is performed also when reduction of the amount of need hydrogen is temporary. Actual processing closes the closing motion bulb 53 of the lower stream of a river of the tank 50 for a buffer, opens the closing motion bulb 52 prepared in the upstream of the tank 50 for a buffer, operates a booster 51, and is performed by sending high-pressure hydrogen into the tank 50 for a buffer. It escapes to "END" after the above processing, and this manipulation routine is ended.
[0047] According to the fuel cell system of this example, from the information on the geographical feature the amount of treading in and vehicle of an accelerator pedal 75 are running Predict the amount of hydrogen by which the need is carried out according to the amount of generations of electrical energy needed from now on, and when the change is temporary It can generate electricity by securing the required amount of hydrogen by correspondence of reflux of unreacted hydrogen, use of the hydrogen in the small-scale tank 50 for a buffer, a rise of the fuel pressure of the body 30 of a fuel cell, etc. Moreover, when it is judged that the increment in the amount of hydrogen needed continues more than at a predetermined period, for example, 30 seconds, the rise of the capacity of the reforming machine 10 is directed with these treatment, and a generation of electrical energy of required power can be continued. Furthermore, when it is judged that the required amount of hydrogen decreases, since the tank 50 for a buffer is filled up with excessive hydrogen, futility of hydrogen is not produced.
[0048] As mentioned above, although some examples of this invention were explained, this invention is not limited to these examples, and can be carried out in various modes, for example, the next deformation is possible for it. Although it judges whether the example mentioned above is sufficient after judging whether only unreacted hydrogen is sufficient after giving the directions which make unreacted hydrogen flow back or giving the directions which open the tank 50 for a buffer It can first judge whether reflux of unreacted hydrogen, disconnection of the tank 50 for a buffer, and the introducing pressure force are sufficient for the insufficiency of hydrogen, and control which branches when each is sufficient, and when insufficient, and supplies only required hydrogen to the body 30 of a fuel cell can be performed.
[0049] Moreover, although unreacted hydrogen is made to flow back, next the tank 50 for a buffer is opened first and the introducing pressure force is made to go up finally, it is not limited to the sequence which is possible also for changing the sequence suitably if needed, and was mentioned above. For example, the tank 50 for a buffer is opened and closed, the insufficiency of hydrogen is compensated, then when insufficient, unreacted hydrogen may be made to flow back, or you may make it usually raise the introducing pressure force at the time. From the first, these the correspondences of all are not indispensable and any of reflux of unreacted hydrogen, use of the hydrogen in the small-scale tank 50 for a buffer, and a rise of the hydrogen pressure force or adopting one do not interfere at all, either.
[0050] Furthermore, although he is trying to compute the initial complement of prospective fuel gas

from a terrain intelligence, it is not necessary to necessarily calculate to the initial complement of prospective fuel gas, and you may make it calculate only the initial complement of the fuel gas in the time from the amount of treading in of an accelerator pedal. Moreover, the initial complement of fuel gas forms a dc-battery between the body 30 of a fuel cell, and the motor for a drive, and you may make it calculate whether it is in the condition which has overload feeling or allowances from the condition of the current of the charge and discharge to this dc-battery. It is as having mentioned above for various kinds of modification to be possible about a terrain intelligence.

[0051] The insufficient situation of the hydrogen needed by the body 30 side of a fuel cell is embraced. Thus, ECU20 The closing motion bulbs 52 and 53 and a booster 51 are controlled. Use the hydrogen in the tank 50 for a buffer, or By controlling the Mikata bulb 43 and a booster 61, making unreacted hydrogen flow back, or controlling boosters 62 and 63 and raising the pressure of the fuel gas of the body 30 of a fuel cell, even if it is the small tank 50 for a buffer, transitional load rapid increase can be conquered and the practical amount of generations of electrical energy can be obtained.

[Translation done.]